

1. (Amended) A reversible physiological process for [the] temporal separation of oxygen evolution to avoid deactivation of hydrogenase in the presence of oxygen[and] and sustain photosynthetic hydrogen production in cells of an algal microorganism, comprising:

- (a) growing a culture of the cells of the algal microorganism in a medium under illuminated conditions to accumulate an endogenous substrate;
- (b) depleting [from the medium] a nutrient selected from the group consisting of sulfur, iron, and/or manganese from the medium;
- (c) sealing the culture from atmospheric oxygen;
- (d) incubating the culture in light [whereby] to provide a rate of light-induced oxygen production [is] equal to or less than a rate of cellular respiration; and
- (e) collecting an evolved gas that includes hydrogen.

2. (Amended) The process of claim 1 [further comprising generating] wherein said hydrogen gas is generated from water and [the accumulated] said endogenous substrate using light and a hydrogenase.

3. (Amended) The process of claim 1 wherein depleting of nutrient is to a concentration of 0.5 millimolar or less.

6. (Amended) The process of claim 2 wherein the algal microorganism is selected from the group consisting of a green, red, brown, and blue-green algae.

10. (Amended) The process of claim 6 wherein the green algae is *Chlamydomonas reinhardtii*.